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A Weekly Summary of Current Science

EDITED BY WATSON DAVIS

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EDWIN E. SLOSSON, Director
WATSON DAVIS, Managing Editor



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HOW TO HEAT YOUR HOME

(Home heating is not just a matter of ordering coal and shoveling it into your furnace. Samuel S. Wyer, associate in mineral technology of the U. S. Smithsonian Institution and a consulting engineer has condensed and codified official government information on correct use of coals, gas, coke and oil in home heating. This is the first of a series of seven articles. Even the veteran fireman who tends his own will learn some new tricks from these articles.)

I. WHAT HAPPENS WHEN FUEL BURNS

By Samuel S. Wyer,
Associate in Mineral Technology,
U. S. Smithsonian Institution.

Burning of every fuel is the chemical combination of the ingredients in the fuel with oxygen of the air. Different fuels require different quantities of air applied in different ways.

One pound of coal, occupying 21 cubic inches, requires about 15 pounds or 200 cubic feet of air. The volume of air is about 16,000 times the volume of coal. One gallon of oil, $7\frac{1}{2}$ pounds or 231 cubic inches requires about 142 pounds or 1,866 cubic feet of air. The volume of air is about 14,000 times the volume of oil. One cubic foot of natural gas requires from 9 to 10 cubic feet of air and one cubic foot of manufactured gas from 4 to 5 cubic feet of air. Efficient fuel use can be secured only by the use of the correct amount of air and applied in the right way. This is entirely in the hands of the fuel user.

No general rule can be given for the exact adjustment of dampers, but proper adjustment must be ascertained by trial with each installation. In the typical house furnace or boiler, the dampers work as follows:

The draft damper, usually controlled by a chain from the living room, is generally a lift door in the ash pit door and admits air underneath the fuel.

The feed-door damper consists of a slide in the feed door and admits air directly over the fire. If opened too wide it acts as a check.

The back damper, usually controlled by a chain to the living room, can admit cold air into the smoke pipe, reducing the chimney draft and retarding the burning of the fuel in the heater. This damper should be closed tight when fresh fuel is added to the fire.

The smoke-pipe damper will control the draft or drawing of the chimney and should always be placed between the furnace and the check damper and never between the check damper and the chimney flue.

The burning of fuel with perfect combustion will produce carbon dioxide, the same gas that is exhaled from the lungs, and water vapor. If the combustion is not perfect, carbon monoxide, a poisonous gas, and condensible vapors and smoke will be formed. No heating device has been or can be made that will absorb its combustion products, hence they must be properly removed from the house by adequate flues.

An opening should be provided at the base of all chimneys for occasional cleaning. Flues for solid fuels require larger connections than those for gas or oil. When bituminous coal is used, horizontal sections of flue pipes require frequent cleaning. With gas, the large amount of steam that must be formed when the gas is burned may give trouble in disintegrating the mortar lining of the ordinary chimney. This moisture is acid and will soon corrode ordinary thin black stove pipe, only galvanized connections should be used and flues should preferably be lined with a moisture proof lining such as heavy steel galvanized pipe. Back or down drafts with solid fuels can be prevented by a hood at the chimney top; with gas, an opening at the bottom of the smoke pipe near the heater will protect.

Tests show that ashes frequently contain 50 per cent of carbon. This is because the grates do not receive proper attention. In shaking grates, stop when the fire glow from above appears and before live coals go into the ash pit. Never leave ashes under the grates after shaking. Remove at once, as this will protect grates and give better circulation of air.

Even with proper combustion of fuel, however, the heating problem is only partially solved. The big task is getting the heat into the room, water or food that is to be heated in the most direct and effective manner. The ordinary furnace or water-heater for the average house does not have enough absorbing surface, with the result that the combustion products go into the chimney at too high a temperature and much heat is needlessly lost. This is especially marked when gas or oil are burned in the ordinary coal furnaces.

Water tanks, furnaces and pipes for hot air, water or steam should be adequately insulated. Merely covering, as is frequently done, with one thin thickness of asbestos sheets is not enough. In fact such a covering is worthless. The insulation must be about one half inch thick to be effective and will then cause a marked saving in fuel.

Gas ovens should be adequately insulated because an insulated oven will give the same service with about one-half of the gas and at greater comfort to the cook.

Use of a thermostat, a device for controlling fuel burning so as to maintain a predetermined temperature in a room, water tank or oven, will always promote economy; saving from 15 to 30 per cent. For room heating it contributes to the good health and comfort of the occupants. Applied to gas ovens it results in saving in burned food, takes the "guess" out of oven cooking and insures duplication of results.

READING REFERENCE - U.S. Bureau of Mines Technical Papers 97, 137, 180, 199, and 208; University of Illinois Experiment Station, Urbana, Illinois, Bulletin 29; Kansas State Agricultural College, Manhattan, Kansas, Bulletin 8; and U. S. Department of Agriculture Bulletin 1194.

DAIRY SCIENCE VITAL TO WHOLE WORLD

Representatives of all phases of the dairy industry in many nations assembled in Washington, Philadelphia and Syracuse, October 2 to 10 for the first World's Dairy Congress since the war. It was the first meeting of the Congress in the United States. Few nations were without a representative.

In his opening address, President H. E. Van Norman of the World's Dairy Congress Association referred to the world wide character of the dairy industry and said:

"This Congress is a recognition of the world character of the dairy industry, of the inter-relationship of all countries engaged in dairying and of the fact that seasonal, climatic, economic and political changes in any country rapidly affect the prosperity of the dairy industry in other countries. Successful leadership seeks increasing familiarity with these world forces. The revelations of science and the accumulated data of welfare agencies show immense, untouched markets in every country in that portion of its population which is underfed because of insufficient use of milk. Wider dissemination of dietary facts is a contribution to human health and to economic prosperity.

"New problems confronting the industry are: The relation of mineral matter to the nutrition of dairy animals, control of costly diseases, increased use of mechanical equipment, the influence of large containers, the application of mechanical refrigeration to geographical distribution and the growth of co-operative organizations.

"There should be a wider cultivation by society of its appreciation of its dependence upon a successful dairy industry and of the great part such an industry plays in lowering the death rate and increasing the physical efficiency of men and women."

International Dairy Trade Large

The international trade in dairy products and especially the commerce across the equator has now become important and of wide extent.

"The outstanding points of significance," said Dr. H. C. Taylor, chief of the Bureau of Agricultural Economics of the U. S. Department of Agriculture, "are the general decline of the United States and Canada as exporting countries, the development of dairying in certain countries of the southern hemisphere and the prominent place obtained by these countries in the world's international trade.

"Refrigeration has made possible the transportation of fresh milk over great distances. The processes of preserving milk through partial or total dehydration have so facilitated trade that by use of them more than two billion pounds of milk were exported from the United States to Europe in 1919.

"The price received for dairy products in any one country is not determined by conditions of supply and demand in that individual country alone but by conditions of supply and demand the world over."

Former Cannibals Drink Milk

Dairying is now an established business on the Fiji Islands, said J. A. Ruddick, Dominion Dairy and Cold Storage Commissioner of Canada and formerly Dairy Commissioner in New Zealand. The latter country is now the largest exporter of cheese in the world, although cheese from South America took first prize in the Royal London Dairy Show last year. He continued:

"The development of dairying in the southern hemisphere can be shown by the proportion of the total butter imports into the United Kingdom. In 1903, they formed 7 per cent of the total importation. In 1914, the proportion was 21 per cent and in 1922-23, 44 per cent. In the case of cheese it is even more striking. In 1903, only 2 per cent of the imports came from below the equator; in 1914, 29 per cent; and in 1922-23, as much as 55 per cent.

"The southern hemisphere has vast areas adapted to dairying which, as yet, have not been developed. Well informed New Zealanders expect to see an increase of 100 per cent in dairy exports in the next ten years. In parts of Australia considerable further development is expected. Even in such an unlikely place as the Fiji Islands, the creamery industry has already been established. There are millions of acres in the two main islands alone that are capable of supporting very nearly one cow to the acre the year around. Alfalfa may be cut ten or twelve times a year. All that is needed is initiative and enterprise.

"The possibilities of increased markets through greater consumption are enormous. A more wide-spread knowledge as to the value of milk and milk products in the diet, and a higher appreciation of milk as a food rather than as a beverage, will yet exert a very large influence on the quantity consumed."

Average American Cow Is Slacker

The average American cow produces less than half the quantity of milk produced by the average cow of the most advanced dairy countries of Europe, former Governor Frank O. Lowden of Illinois, president of the Holstein-Friesian Association, told members of the World's Dairy Congress. One reason was, he stated, that only three per cent of American cows were pure-bred.

After relating the history of the various pure-breed associations in this country, Gov. Lowden said:

"The most valuable work of the pure-breed associations, from the standpoint of the public, is the vast improvement they are bringing about for better and more efficient cows. The improved cow means decreased cost of milk, an indispensable food. All our people profit by this.

"It is the pure-breed dairy associations that are making the most persistent and effective fight against the scrub cow, which still remains in overwhelming numbers upon the farms of America. Calf clubs are being organized all over the country, composed of boys and girls who become owners of one or more pure-bred or high-grade calves. Through the activities of these calf clubs the dairy cattle of the community begin to improve.

"The pure-breed associations are waging a continual fight against the scrub bull. Recently in one state a most effective drive has been made by the united forces of the pure-breed dairy associations and the pure-breed beef cattle associations. This campaign will add to the wealth of the State and the well-being of her citizens. It is possible by this method to secure the cooperation of the business interests of the community. In an agricultural community all are interested in improved farm conditions."

Milk Makes Students Alert

Nutrition classes show many cases of children inadequately nourished, physically inactive, listless and poor in their school work, who as a result of being taught to use a proper quantity of milk, increased in weight, and became active, alert and happy, W. A. Wentworth, secretary of the Ohio Dairy Products Association told the Congress. In Dauphin County, Pennsylvania, a survey was made by the State Agricultural College, and the Dairy Council was asked to cooperate in a year's campaign, he said. In towns where children became regular milk drinkers, only 11 per cent of the school children were found seriously under weight, as compared with 33 per cent in the country at large.

Dried Milk Good Food For Growing Children

Rapid improvement in the manufacture of dried milk: has resulted during the past 15 years in a 150 fold increase in consumption of that commodity in Great Britain, Col. R. I. Blackham, formerly of the British Army Medical Service told the delegates. During the same period there has been a marked decrease in the infant mortality. It is now possible, he said, to prepare milk powder of such purity as to be almost absolutely free of bacteria, and emphatic clinical evidence has been given that such milks are adequate for the nourishment of the growing child both with respect to vitamin value and digestibility.

The anti-scorbutic vitamin is the only one seriously affected by the process of drying milk, Dr. Cornelia Kennedy of the University of Minnesota stated. She said that the injury was much less if the drum method of drying rather than the spray method was used, and the same thing was true to a less extent in the case of the growth producing vitamin, while the vitamin which prevents various forms of neuritis was unaffected by either form of drying. Children fed dried

milk grew as well as those which were breast fed, and had no greater tendency to develop rickets and scurvy, she said.

Milk Made Bread Perfect Food

White bread to which milk, lime salts, and an extract of the wheat germ are added in the making was palatable and a nearly perfect food, said R. M. Allen of New York, director of the research laboratory of a large baking company. Animals fed exclusively on this bread and water have grown, thrived, and reproduced to the seventh generation, he declared. Children to whom this bread is given as their only cereal food in an otherwise mixed diet show faster growth than those also receiving a mixed diet but fed ordinary white bread, Mr. Allen stated, ascribing the reason to the presence of essential vitamins and mineral salts in the bread.

Quart Of Milk Daily Needed By Children

Every child should drink a quart of milk every day if its bones and teeth are to be properly nourished, said Dr. Henry C. Sherman of Columbia University. This quantity has been found to be the most favorable for child nutrition as the result of a series of experiments conducted upon average children from three to thirteen years of age by Columbia University and the New York Association for Improving the Condition of the Poor. It was found that while a diet that included about three fourths of a quart of milk a day resulted in the child accumulating small quantities of lime and phosphorous, the essential bone forming substances, a diet of a quart a day gave a much better result. Children so fed showed a better development of bones and teeth. It was proved that milk was better than vegetables as a source of lime.

Dr. C. J. Hastings, medical health officer of Toronto, told the Congress that adults should drink at least a pint of milk a day in order to keep up the lime supply. He advocated supervision of the milk supply from the cow to the consumer and urged pasteurization of all market milk.

"The milk of any community can only be made safe at all times", he said, "by rendering it bacteriologically clean by scientific pasteurization. Objections raised to pasteurization are, for the most part, a pitiful exhibition of ignorance on the part of the objectors, but such 'fossils' die hard."

Ice Cream Popular

The growth of the ice cream industry in the United States was described by Prof. Martin Mortensen of Iowa State College. The first wholesale ice cream business was started here in 1851, but the period of most rapid growth had come in the last dozen years, he said, production having risen from 80 million gallons in 1909 to more than 263 million gallons in 1922.

READING REFERENCE - Sherman, M.C. Food Products. New York, Macmillan Company, 1921.

McCollum, E. V. The Newer Knowledge of Nutrition. New York, Macmillan Company, 1922.

WORMS TURN AND LEARN; BRAINS ARE IN TUMMIES

Earthworms have memory and may be trained in the way they should go, but their brains are not in their heads but in their abdomens. Professor L. Heck of the University of Prague has announced this discovery as the result of experiments with a collection of worms, some 500 in number. They were introduced into a passage shaped like a capital T and carved from a block of wood which was covered with a glass plate so that the movements of the little creatures might be observed. When they came to the junction about half of them turned one way and half the other.

Then it was arranged so that those that took the left-hand passage received a mild, but presumably disagreeable electric shock. At first the worms did not know just what to make of all this, but after they had all been through the experience about 200 times, they nearly all were converted to "safety first" and took the right hand turn. When the electrodes were then moved to the right hand passage they learned to shift to the other after only 35 passages, evidently showing more aptitude.

In the human sense, earthworms have no brains, their nervous systems consist of a series of little ganglions, or nerve centers, on the under side of the worms and connected with each other by nerve fibers. If the worms were cut in two, the fragments still showed the ability to distinguish between the safe and the unpleasant road to travel, showing that the earthworm remembers in every one of his ganglions, and is able to learn and profit by experience, which in spite of their higher organization many men are unable to do.

SPEEDIEST MACHINE TO AID AIRPLANE IN WEIGHT RECORD ATTEMPT

By using a new device which feeds his engine air at normal sea-level, Lieut. John A. Macready of the U. S. Army Air Service will attempt within the next few weeks a rise to atmospheric heights rarer than those ever reached by man. The new equipment is now being installed on his plane at McCook Field. Lieut. Macready was holder of the world's altitude record of 34,509 feet until two weeks ago when Sadi LePointe, a French aviator, was officially recognized as world champion with a record of 35,178 feet.

The "ceiling" for an ordinary airplane is about 21,000 feet, because the air above that is too rare to support combustion in the engine. In establishing his present record, Lieut. Macready made use of a supercharger which supplied his engine with the necessary oxygen by compressing the rarified upper air through which the plane climbed. The much more efficient device, designed and built by the General Electric Company, which is now being placed on the plane will feed atmospheric pressure to the engine at 55,000 feet, it is claimed.

This supercharge is mounted just back of the propeller blade of the plane on the front end of the Liberty motor. It is operated from the motor's red hot exhaust, which ordinarily goes to waste. Its weight of about 140 pounds will cause a small loss of speed at the low altitudes, but will produce a decided gain in power at 35,000 feet equal to about two horse power for each additional pound carried.

The pressure of the atmosphere at an altitude of 35,000 feet is about one-fourth that at sea level. The temperature is 58 degrees Fahrenheit below zero. To supply the airplane engine its normal air at sea level pressure, the supercharger is designed to compress about 2,200 cubic feet of atmosphere per minute. The new supercharger has a rated speed of 33,000 revolutions per minute, but in tests at the Lynn Works of the General Electric Company, it was operated up to 41,000 revolutions per minute, or 683 turns of the compressor wheel a second, a speed greater than ever before developed by a commercial machine.

To better visualize what such speed means, Dr. S. A. Moss, engineer who designed the supercharger, has figured out that if any small object were placed at the outer end of one of the small revolving propeller blades it would travel 1,880 feet per second, or about three fourths the speed of a bullet from an army rifle.

Any object revolving at this terrific speed has an enormous centrifugal pull, and Dr. Moss in tests has determined that if a one pound weight, with its center of gravity located at the center of gravity of the supercharger blades, was revolved at 41,000 revolutions per minute its centrifugal force would be 222,000 pounds, or 111 tons. The blade of the machine, however, weighs but nine-thousandths of a pound and the centrifugal force per blade in the supercharger is therefore about 2,000 pounds.

MYSTERIOUS TRIBE IN LABRADOR PUZZLES SMITHSONIAN EXPERT

In the little known northwest part of the Labrador peninsula; where existing charts show rivers and trails which do not exist and where rivers and paths run which are not charted, is a mysterious people who speak an unknown tongue, Dr. Truman Michelson, specialist in Algonkian languages of the Bureau of American Ethnology of the Smithsonian Institution, has discovered. He has just returned from exploration in the wilds of Labrador. The Nascapee Indians which live to the east of the mystery tribe are unable to understand them.

Who these people are is not known, said Dr. Michelson today to a Science Service representative. The Nascapee cannot understand them although they can understand the Eskimos, with whom they come into contact to the north, and the Cree and other closely related Algonkian Indians.

Dr. Michelson found that the supposed differences between the Nascapee and Montagnais dialects do not exist and also discovered elements in the language of the Penebscot Indians near Old Town, Maine, which showed an Eskimo influence.

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STRUCK BY LIGHTNING TELLS HOW IT FEELS

Death from a lightning stroke may not be as painless as has been supposed, if the experience of M. L. McQueen, instructor at the University of Wisconsin, who was struck and recovered is typical. The incident occurred this summer and has just been reported in detail to the U. S. Weather Bureau by Eric R. Miller, meteorologist in charge of the local office at Madison, Wis.

McQueen was walking across an open lot in company with another instructor, W. E. Armentrout, who was killed by the bolt. McQueen remained conscious throughout his experience and fully realized what was happening to him. Relating it some days afterwards he said the pain from the spasmodic contractions of his muscles was terrible, but was nearly equalled by that due to the terrific heat of the flash and the noise. He also suffered from a sensation of intense pressure in the head.

The current entered his body at the left shoulder which was seared over an area of four square inches. His leg muscles near the ankles were sprained and wrenched by spasmodic contractions. He was paralyzed from the waist down for several hours and was weeks recovering from the burns and the injury to his muscles.

That iron has little directive effect on lightning is indicated by the fact that a railroad rail lay only 10 feet away from the two men, railway construction work within 30 feet, while within less than 50 yards were a tall crane, wire fences, and buildings. An iron smokestack was not much further away in the direction from which the cloud had come.

SEED POTATOES THRIVE AFTER SALTPETER BATH

How to make two crops of white potatoes grow where only one grew before has been simplified by a discovery of Prof. Joseph T. Rosa of the University of California. The difficulty in sections where two crops are possible has been that the seed potatoes from the first crop must be seasoned three or four months before planting if they are to sprout readily.

Professor Rosa has found that if the new seed potatoes are cut up in the usual way for planting and then dipped into a weak solution of nitrate of soda for from thirty minutes to an hour a short time before they are put into the ground they will sprout as quickly as seasoned seed. The common fertilizer grade of nitrate of soda can be used at the rate of 3 and a half pounds to 10 gallons of water, and as the solution may be used repeatedly the cost is very small. In an experiment started Feb. 23, 1923, seed potatoes treated by this method came up quickly and gave practically a 100 per cent stand by April 3, while untreated seed came up much more slowly and did not show a full stand until April 21, nearly 3 weeks later. It was found that the treatment was useless unless the tubers were cut before dipping in the solution. Besides enabling the potato grower to use his early crop potatoes to plant a fall crop and thus get two crops in one year on the same land, Professor Rosa believes that the new treatment will enable growers to mature their early crop still earlier than at present, and thus get the benefit of the higher prices that usually prevail for

early potatoes. It may be entirely possible, he says, to make important potato states like New Jersey, Virginia, the Carolinas, Florida, and California independent of the more northern states from which they usually obtain most of their seed potatoes for planting.

WIRELESS NORTH POLE HEARS FROM HAWAII

Hawaiian radio waves have reached the Wireless North Pole, WNP, as the radio station of MacMillan's arctic expedition, now in winter quarters at Refuge Harbor about ten miles north of Etah, Greenland, is called. Through a British Columbian amateur station Donald H. Mix, radio operator for WNP, has reported to the American Radio Relay League here that he heard 6CFU in Hawaii. He is, however, unable to make his powerful radio transmitter heard farther south than northern Canada.

RADIO JOY RIDER STEALS AMATEUR SET

Amateur radio station 9AZH at Rolla, Missouri, is silent. It has been stolen.

The day of the radio joy rider is here, according to S. P. Stocking, the owner of the missing station. Every piece of his \$1,500 sending set was carried away by the thieves who made two visits to his station. Believing that the thieves are operating the stolen apparatus, Stocking has asked fellow members of the American Radio Relay League to be on the alert.

It is proposed next year to erect a chain of radio stations to connect mining camps in the Mackenzie River Valley in northern Canada.

Nearly one-fourth of the merchantable timber of the United States is Douglas fir.

A species of African monkey, hitherto unknown to science, has recently been discovered.

Along the entire lower California coastline longer than from Key West to Boston, there is only one all the year round stream entering the sea.

A Chinese general plans to teach Chinese soldiers scientific cultivation with modern farm machinery and then organize them into labor brigades for colonization of the vast waste lands of northwest China.
